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PATENT APPLICATION
DOCKET NO.: TEX98-01A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: David M. Mayes

Appl. No.: 09/019,667 Group: 2877

Filed: February 6, 1998 Examiner: Nguyen, T.

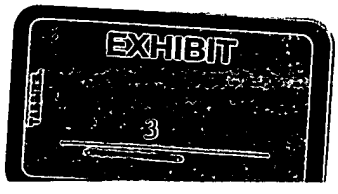
Title: GRAIN QUALITY MONITOR

DECLARATION OF CHARLES W. VON ROSENBERG, JR.

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

1. My name is Charles W. von Rosenberg, Jr. I am employed by Textron Systems Corporation in Wilmington, Massachusetts. I hold an M.S. in Aerospace Engineering from M.I.T., a PhD in Engineering Sciences from the University of Oklahoma, and did post-doctoral studies at the University of Southampton (England).
2. I have utilized spectroscopy throughout my research and development career beginning with my use of infrared emission measurements for understanding the excitation of molecular vibrations in my doctoral thesis studies, in the mid 1960's. I am, and have been since 1992, a Visiting Scientist in the George R. Harrison Spectroscopy Laboratory at M.I.T.



3. Dr. Mayes' invention involves the placement of an optical spectrometer into a harvester or other mobile agricultural equipment. Adapting an optical spectrometer for use right within the mobile agricultural equipment makes practical the measurement of properties such as protein, oil, and moisture in grain and other agricultural products, in real time, in the field, during harvest and at other times. (Refer to the pictures shown in Appendix A).

4. Adapting an optical spectrometer to a combine or other mobile agricultural equipment provide a number of new advantages.

5. For example, with the present invention the farmer himself will be able to sort his product according to these different intrinsic properties, as it is being harvested.

6. Furthermore, continuously monitoring the properties of grain as it is being harvested reduces statistical errors which occur when the grain properties are measured by submitting only small samples for analysis, such as in a laboratory or at the grain elevator.

7. By having this information available to him at the time of harvest, the farmer will also gain an understanding of the details of the agronomy of his particular field, season by season. For example, the information provided by the Mayes device will also add to the information that growers have been gaining from other "Precision Agriculture" equipment in recent times.

8. One such precision agriculture system is illustrated in the accompanying Case Corporation brochure which describes their Advanced Farming System (Appendix B). Such equipment presently enables the grower to measure yield (bushels/acre) and moisture (% content) using individual sensors with the simultaneous measurement of precision location in the field using system integrated Global Positioning System (GPS) equipment. These measurements are displayed to the operator, in real time, in the cab of his combine. The information is also stored on portable magnetic media, transportable to the home/farm computer where farmer friendly software enables

false color field plots displaying spatially resolved yield information. With Mayes' invention, the grower will now be able to add additional map overlays displaying protein, oil and other quality properties to the present yield maps provided by such systems.

9. As shown in the accompanying charts (Appendix C and D), the specific configuration of the optical spectrometer in the Mayes' device is fundamentally different from and not suggested by the devices described in the Tobler and Labaw patents.

10. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this Declaration is directed.

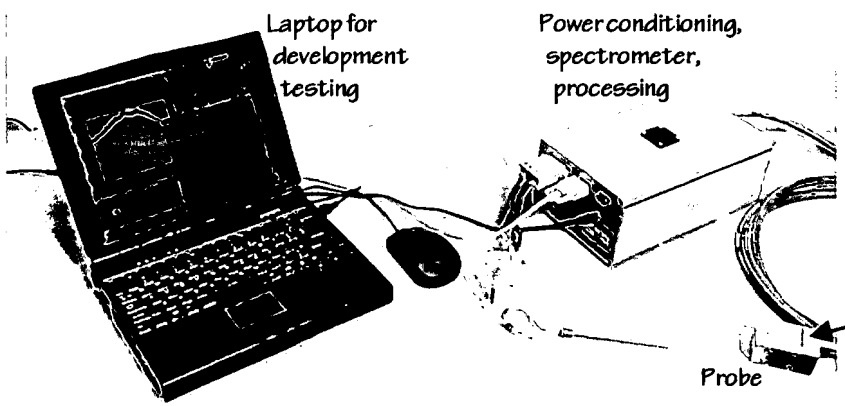
Charles W. von Rosenberg, Jr. (date)

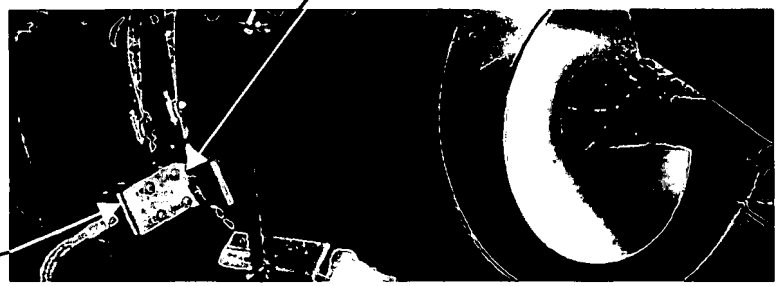
Hardware: rugged enough for farm and field

Combine harvesting wheat

Probe

'98 Field Test Configuration



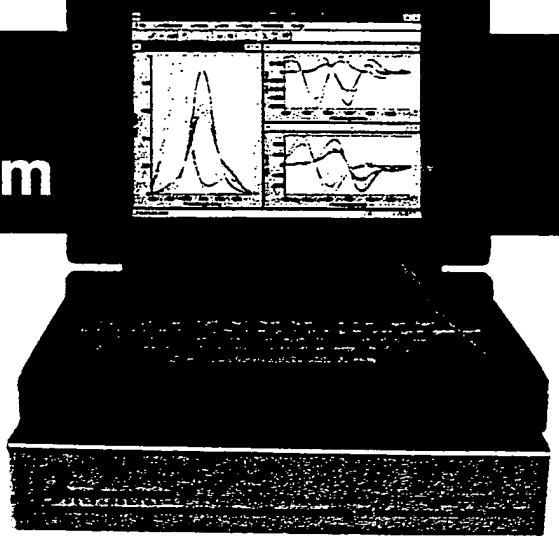


Real time data in the field:

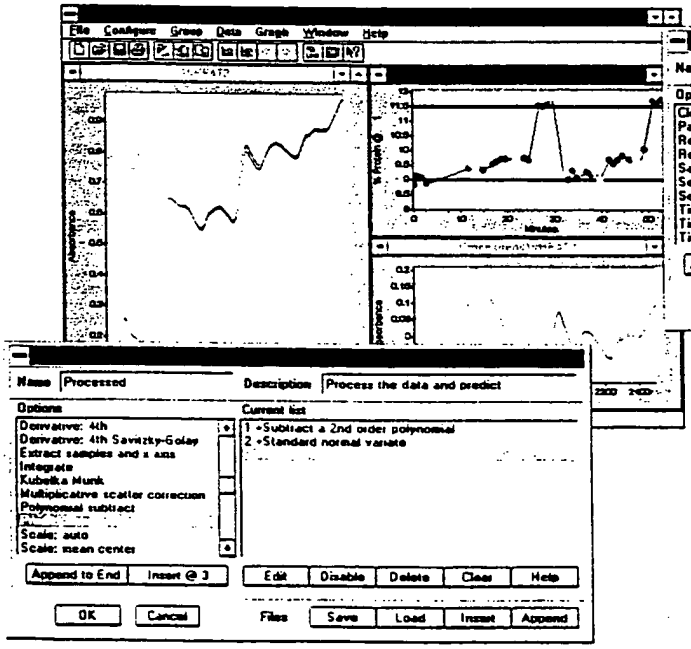
- ***Sort harvested grain by protein, oil, moisture***
- ***Agronomic understanding and improvement***

Complex Problems?? Simple Answers!!

The DPA20 CCD Spectrophotometer System



- Visible and NIR versions
- 1024 element CCD array
- 128 and 256 element PbS arrays available
- Photo feedback stabilized lamp
- Fiber optic / remote sensor ready
- Powerful, intuitive Windows software
- Point and click method development
- Small, portable, rugged, stable, and easy to use turnkey system
- Direct control of pumps, valves and other I/O from Valco, Cavro, Alitea, etc.
- Directly supports Matlab, Excel, Pirouette and other data analysis applications



DSquared Development's 'DεLight' software allows the user to easily analyze and view data, control instrument features, and build complete custom configurations for routine analyses.

DSquared Development Inc.
1108 J Ave.
La Grande. OR 97850
Phone 541.963.9151 / Fax 541.962.7520

Appendix C

AX5

DPA20 Applications (a rather brief list...)

Visible 400 - 700 nm

Flow analysis based systems for:
- simultaneous Co, Cu, Fe, Ni, Zn analysis.
- pH (1-13).
- ammonia and phosphate.
- many others.

Fiber optic sensor based applications.
Clinical analysis.

SW-NIR 650 - 1100 nm

Long path lengths from 1 - 10 cm.
Hydroxyl number of polymers.
% fat in meat products.
% oil / moisture of margarine (>1 cm path length).
Octane of gasoline.
Diffuse transmission of intact pharmaceutical tablets.

NIR 1100 - 2500 nm

Agricultural products
Food processing.
Moisture analysis.
Petrochemicals.
Pharmaceuticals.
Polymers.

Fiber optic accessories

The DPA20 has been designed to accept a wide variety of transmission, diffuse transmission, diffuse reflectance, and reflectance accessories. Standard and custom probe assemblies are available as well as a number of probes from Galileo and other third party sources. Call today to discuss your specific applications.

A flexible spectrophotometer platform for your specific sensing application.

The DPA20 is designed to be a flexible spectrophotometer platform to solve a wide range of sensing applications including at-line and on-line process monitoring, Flow Injection and Sequential Injection Analysis (FIA and SIA), portable remote sensing, custom fiber optic sensors, and many others. The user can easily acquire spectral data and control and monitor external I/O devices and sensors all from a single box using 'DεLight', DSquared Development's sophisticated, easy to learn, Windows based software. The DPA20 is also uniquely packaged in an 8 x 11 x 2 inch enclosure designed to fit directly beneath a laptop computer and for easy transportation to a remote site. It can also be mounted in a NEMA rated enclosure for more demanding installations.

Please call for information regarding custom applications and turnkey sensor systems.

DPA20 System Specifications

Spectral Regions	Vis 400 - 700 nm. SW-NIR 650 - 1100 nm. NIR 1100 - 2200 nm and 1500 - 2500 nm (call for other optional regions)
RMS Signal to Noise	15000:1 in 2 seconds at 600 nm, 850 nm, and 1500 nm. (16 bit A/D)
Spectral Resolution	Vis 10 nm @ 500 nm. SW-NIR 16 nm @ 850 nm. NIR 10 nm @ 1500 nm
Data Resolution	Vis 0.33 nm / pixel. SW-NIR 0.50 nm / pixel NIR 8 nm / pixel (128 element) NIR 4 nm / pixel (256 element)
Scan Rate	Vis and SW-NIR 20 ms / scan to 5 seconds / scan NIR 1-100 ms / scan Programmable in 1 ms intervals.
Spectral averaging	On board μProcessor controlled, user programmable from 1 to 60000 spectra.
Lamp	Photo feedback tungsten/halogen (drift < 0.001 AU per hour).
Digital I/O	8 input and 8 output.
Analog I/O	2 0-10 volt in (12 bit). 2 4-20 mA out (12 bit).
Size	Vis/SW-NIR version 21x28x5 cm (8.5x11x2 inches), NIR version 3 inches tall.
Weight	4 kg (8.5 lb.).
All specifications subject to change without notice	

Call DSquared Development or your local representative TODAY for more information

DSquared Development, Inc. 1108 J Ave., LaGrande OR 97850 541-963-9151, 541-962-7520 (FAX)
http://www.dsquared-dev.com

Spectral Image Detector